# Portsmouth Naval Shipyard Lean Manufacturing Implementation

Presented to:
Advanced Production, Quality and Manufacturing Course

Captain P. M. Delpero
30 April 2002

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Overview

- Introduction/Background
- Shipyard Overview
- Work
- Workforce Management
- Lean Initiatives
- Summary

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Introduction

- Captain Philip M. Delpero, Operations Officer, Portsmouth Naval Shipyard
- Other duty stations
  - Naval Reactors, Washington, D.C.
  - Mare Island Naval Shipyard, Vallejo, CA
  - Portsmouth Naval Shipyard, Kittery, ME
  - SEAWOLF Program Office, Washington, D.C.
- Education
  - B.S. Nuclear Engineering, Penn State
  - M.S. Mechanical Engineering, MIT
  - M.S. Naval Architecture/Marine Engineering, MIT
  - Level 3 Program Management Career Field

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Roles and Capabilities

Facilities and people to provide a full range of submarine maintenance and modernization

- Industrial Plant
- Engineering Disciplines
- Production Trade Skills

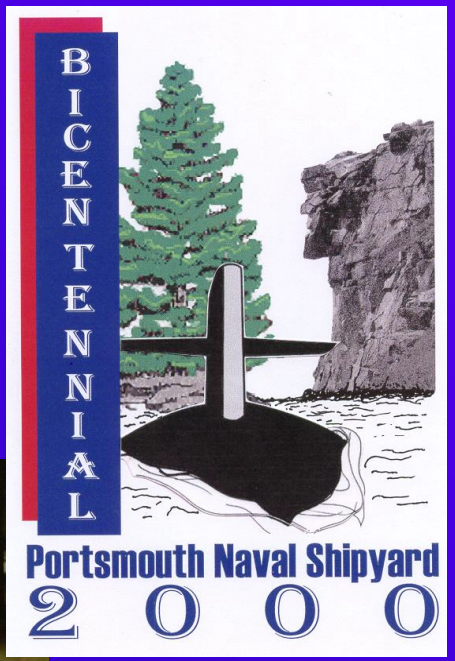
NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Shipyard Characteristics

- 275 Acres on Seavey Island in the Piscataqua River
- 25 Acres in Kittery, Maine (Military Housing)
- 234 Units of Housing
- 3 Drydocks
- 4100 Civilian Workers (excluding apprentices)
- 32 Naval Officers and 72 Enlisted Personnel

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# History



- Established June 12, 1800
- Treaty of Portsmouth - 1905
- Museum and Visitor Center

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Technology Transfer Office

Shipboard Microwave Wastewater Treatment

Photoluminescent Technology

Plasma Arc Cutting

Standing Wave Reflectometer

Wearable PC

High Performance Brush

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Key to Success is On-time, Affordable Quality Performance

**Increase Revenue**

- Technology Transfer
- Partnering
- Outleasing
- Marketing Unique Capabilities

**Reduce Operating Expenses** = **Affordability**

- Process Improvement/Technology Transfer
- Partnering
- Outleasing
- Facilities Consolidation/Demolition
- Energy Conservation
- SMART Base Initiatives

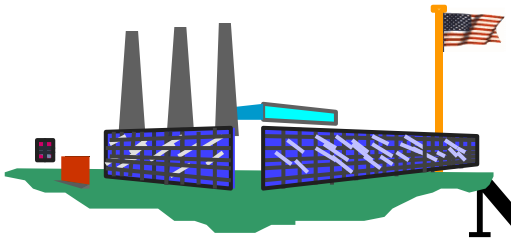
**More Customer Value**

# The Environment has Changed

1990

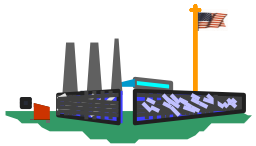
2002

## Decreased Plant Capability



8 NSYs

4 NSYs



## Reduction in Manpower

60K - 70K Personnel

22K Personnel

## Increased Demand

17 EROs/DMPs/ EOHs

44

EROs/DMPs/EOHs

Last 7 Years

2002

Next 7 Years

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Shipyard Hiring Plan

| Occupation | FY97 | FY98 | FY99 | FY00 | FY01 | Goal* FY02 | Onbd FY02 |
|---|---|---|---|---|---|---|---|
| Mechanics / Apprentices | 35 | 69 | 205 | 286 | 228 | 277 | 142 |
| Engineers/ Technicians | 1 | 28 | 83 | 79 | 101 | 133 | 38 |
| Clerical/Admin/ Miscellaneous | 8 | 5 | 11 | 11 | 17 | 6 | 9 |
| Fire/Police | 0 | 8 | 10 | 23 | 20 | 8 | 8 |
| Total: | 41 | 116 | 309 | 405 | 424 | 427 | 196 |

*FY02 Goal subject to review upon finalization of FY03 workload

(FY03 through FY05 hiring estimated in the range of 200 per year to account for attrition)

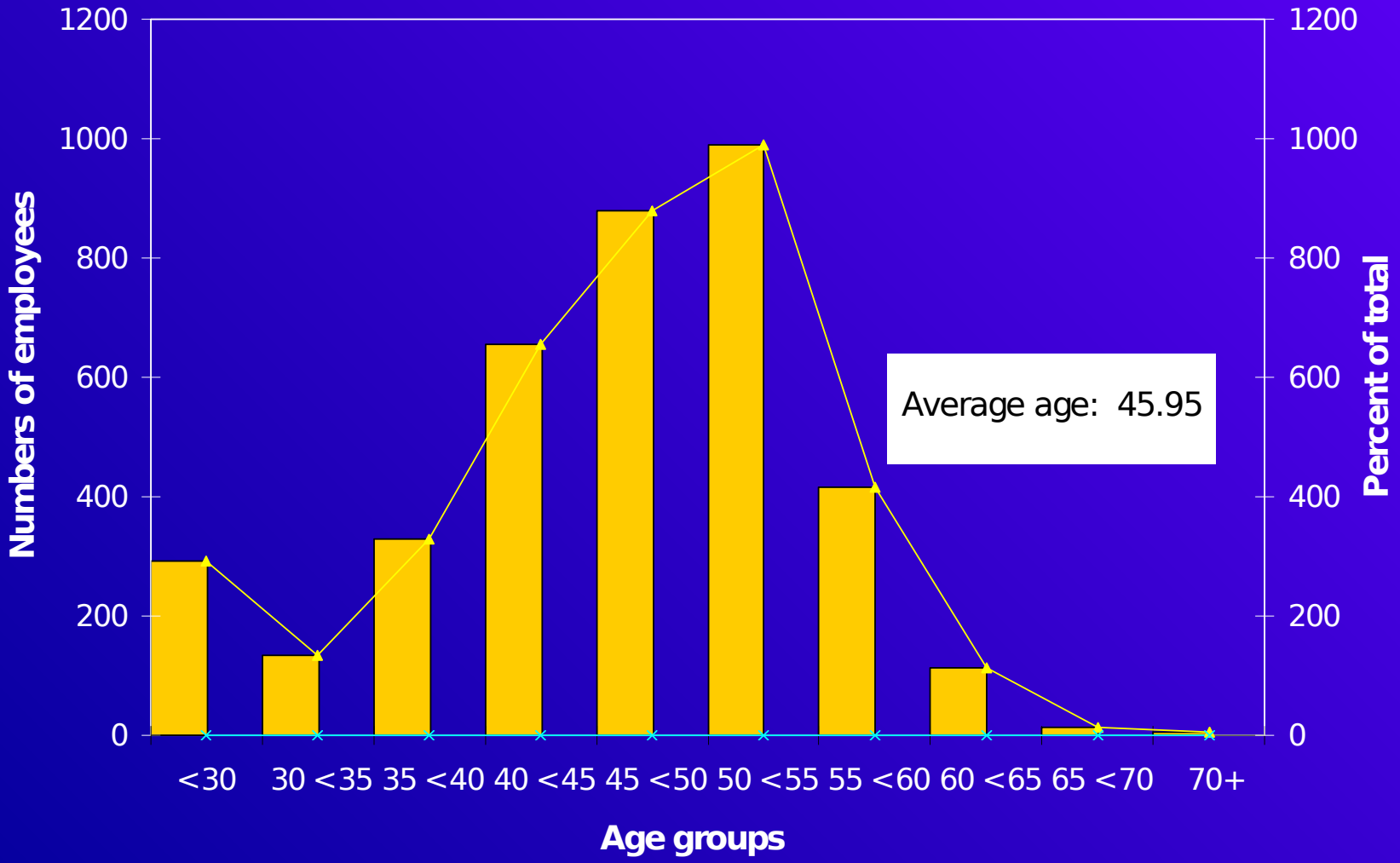
NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Revitalization

- Apprentice Program - Congressional Appropriations
- Engineer Hiring
- Demographics - Average age down from 48 to 45

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

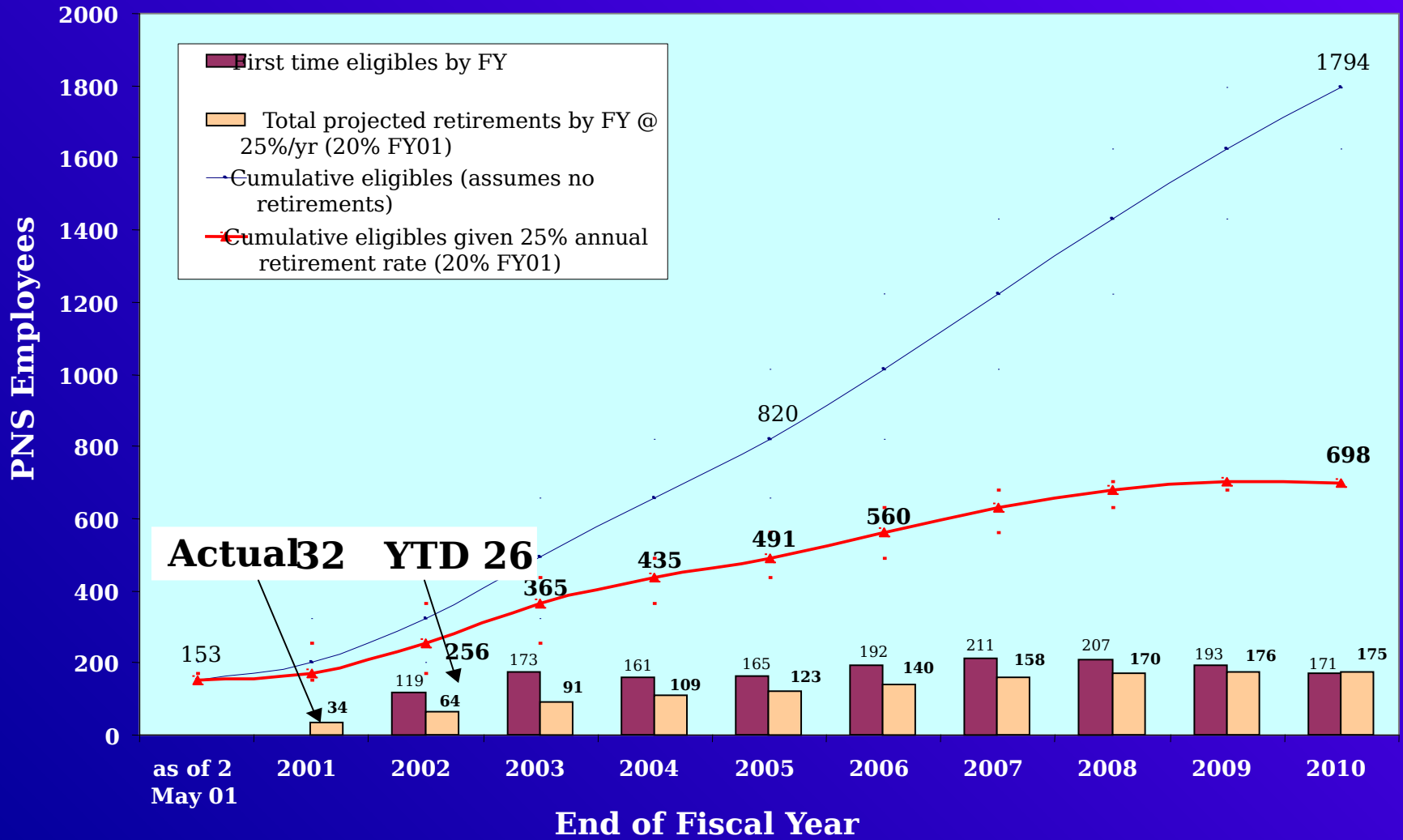
# Age Distribution



NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Optional Retirement Potential

## 4100 Employees



NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

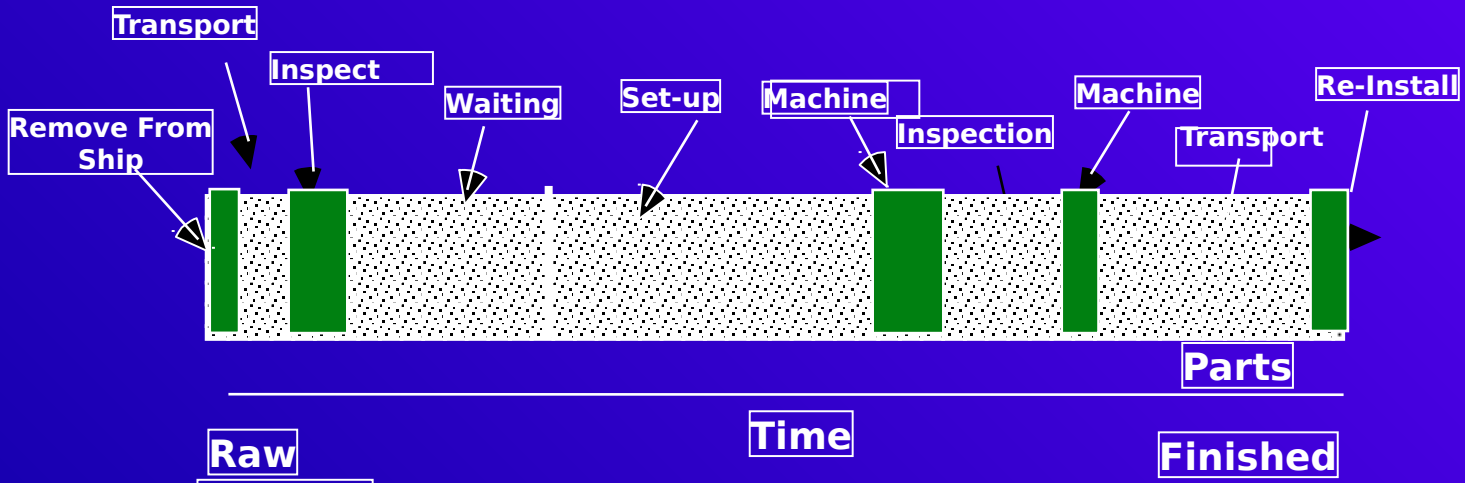
# What is Lean?

- First, Lean isn't:
  - an inventory reduction program
  - a housecleaning program
- Lean is a War on Waste:
  - Lean Manufacturing defines waste as actions that do not add value to the product
  - Value is defined as actual changes to the product that the customer wants
  - Naval ship maintenance industry has non-value added but required process steps
- Lean Manufacturing applies in maintenance/repair industry

**Lean Production (MIT-Womack)**
**T.P.S. - Toyota Production System (Toyota)**
**WCM - World Class Manufacturing (Schonberger)**
**FPS - Ford Production System (Ford)**
**BPS – Boeing Production System (Boeing)**

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Product Lead-time



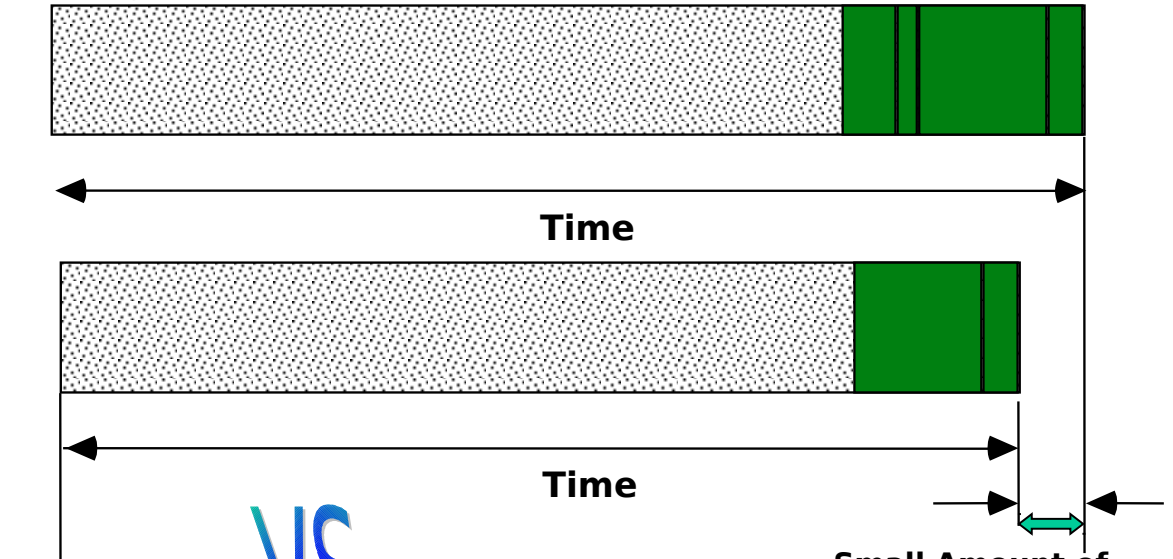

= Value Added Time

= Non-Value Added Time (WASTE)

- Value Added Time is only a very small percentage of the Leadtime.
- Traditional Cost Savings focused on only Value Added Items.
- *BETTER: LIST ALL STEPS AND TARGET THE NON-VALUE ADDING ONES*!

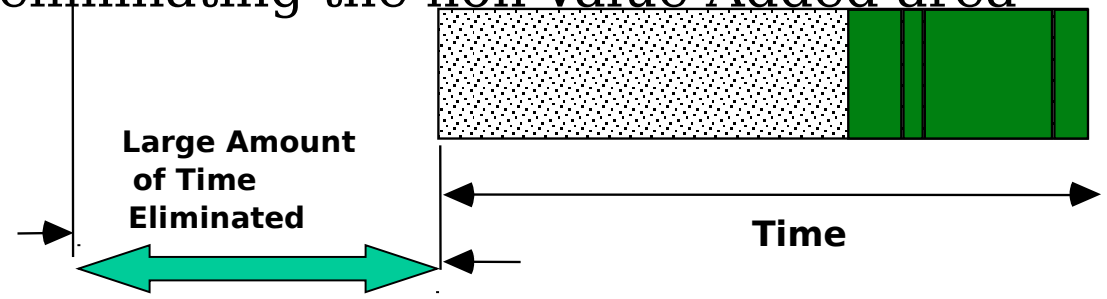
# Traditional vs. Lean Results

Traditional Process Improvement Results
Focuses on improving the Value Added area




-VS-

Lean Results
Focuses on eliminating the non-Value Added area



NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# The Seven Wastes in Manufacturing

1. Over Production--Producing more material than is needed before it is needed is the fundamental waste in lean manufacturing.
2. Excess Inventories--Material sits taking up space, costing money, and potentially being damaged. Problems are not visible.
3. Waiting--Material waiting increases lead time and cost without adding value to the product.
4. Producing Defective Products--Defective products cause rework, impede work flow and lead to wasteful handling, time, and effort.
5. Motion--Toolrooms.
6. Transportation--Moving material between work sites does not add value.
7. Processing--Over engineering, inspections, layers of document review.

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Inventory Hides Waste

RAW MATERIAL

FINISHED PRODUCT
TO CONSUMER

## SEA OF INVENTORY

POOR SCHEDULING

QUALITY PROBLEMS

LONG SET-UP TIME

LINE IMBALANCE

LACK OF HOUSE KEEPING

MACHINE BREAKDOWN

LONG TRANSPORTATION

VENDOR DELIVERY

ABSENTEEISM

COMMUNICATION PROBLEMS

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Exposed Waste

## "Make Problems Visible"

## SEA OF INVENTORY

POOR SCHEDULIN G

QUALITY PROBLEMS

LONG SET-UP TIME

LINE IMBALANCE

LACK OF HOUSE KEEPING

MACHINE BREAKDOWN

LONG TRANSPORTATION

VENDOR DELIVERY

ABSENTEEISM

COMMUNICATION PROBLEMS

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Lean Manufacturing Implementation

- Leadership from the top

  Biweekly Focused Reading, Learning, Strategy Sessions with Key Managers

- Move out with Focused Work Shops - they produce solid results

  Shop 31 Ball Valve Workshop
  - Reduce Mechanic Walk Distance by 60%
  - Improved Floor Space Utilization by 51%
  - Part Travel Distance reduced by 50% Average
  - Lead Time Reduced by 25%

  SHAPEC Job Summary Process Workshop
  - Engineer travel distance reduced by 96%
  - Handoffs reduced by 40%
  - Process Steps reduced 53%
  - Lead Time reduced from 55 days to 27

- Information Sharing with Industry

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Summary of "Tools" Used

## Ball Valve Repair Shop

### *Rapid Improvement Workshop*

- **Waste Walk**
- **5-S**
  - **Sort/Scrap**
  - **Straighten/Set In Order**
  - **Shine**
  - **Systemize/Standardize**
  - **Sustain**
- **Visual Management**
- **Brainstorming**
- **Value Stream Mapping**
- **"Just Do It"**

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Specific Goals of Workshop:

- Improve Safety – 100% (Preventive Actions)
- Improve 5S
  - Identified 132 Tagged Items
  - Goal is to address 90 of them
- Reduce Mechanic Walking Distance – 20%
- Improve Lead Time by 10%
- Improve Floor Space Utilization – 25%
- Reduce Part Travel Distance – 20%
- Improve Visual Control Usage by 80%

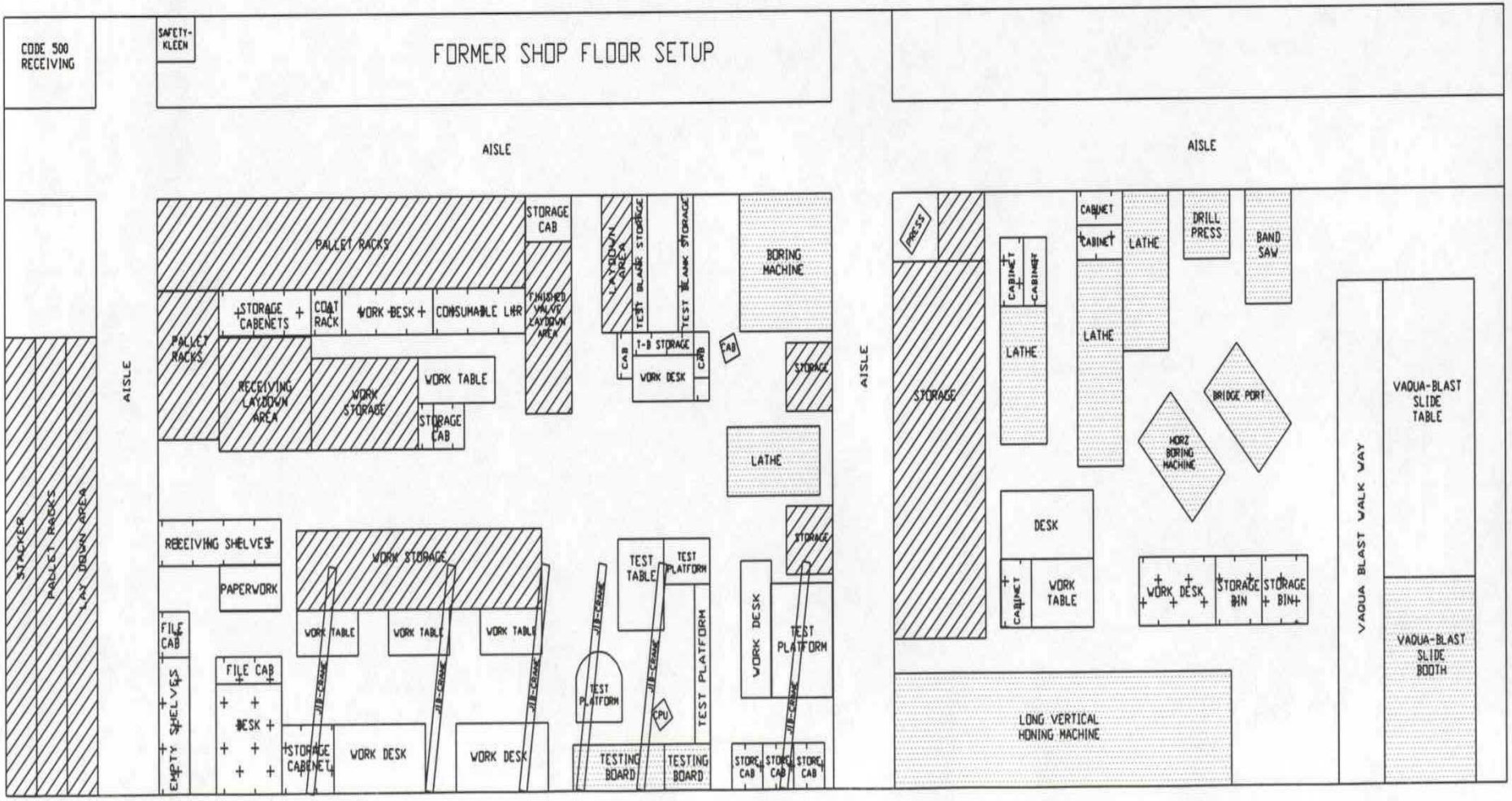
NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Before Situation Measures

- Key Measures
  - Usable Floor Space – 1,710  Square Feet
  - Mechanic Walking Distance – 12,552 ft (2.4 Miles)
  - Lead Time – Average is 175 days (approximated)
- 80 5-S Items Identified
- Waste Walk
  - Identified 30 items (Motion, Transport, Waiting…)

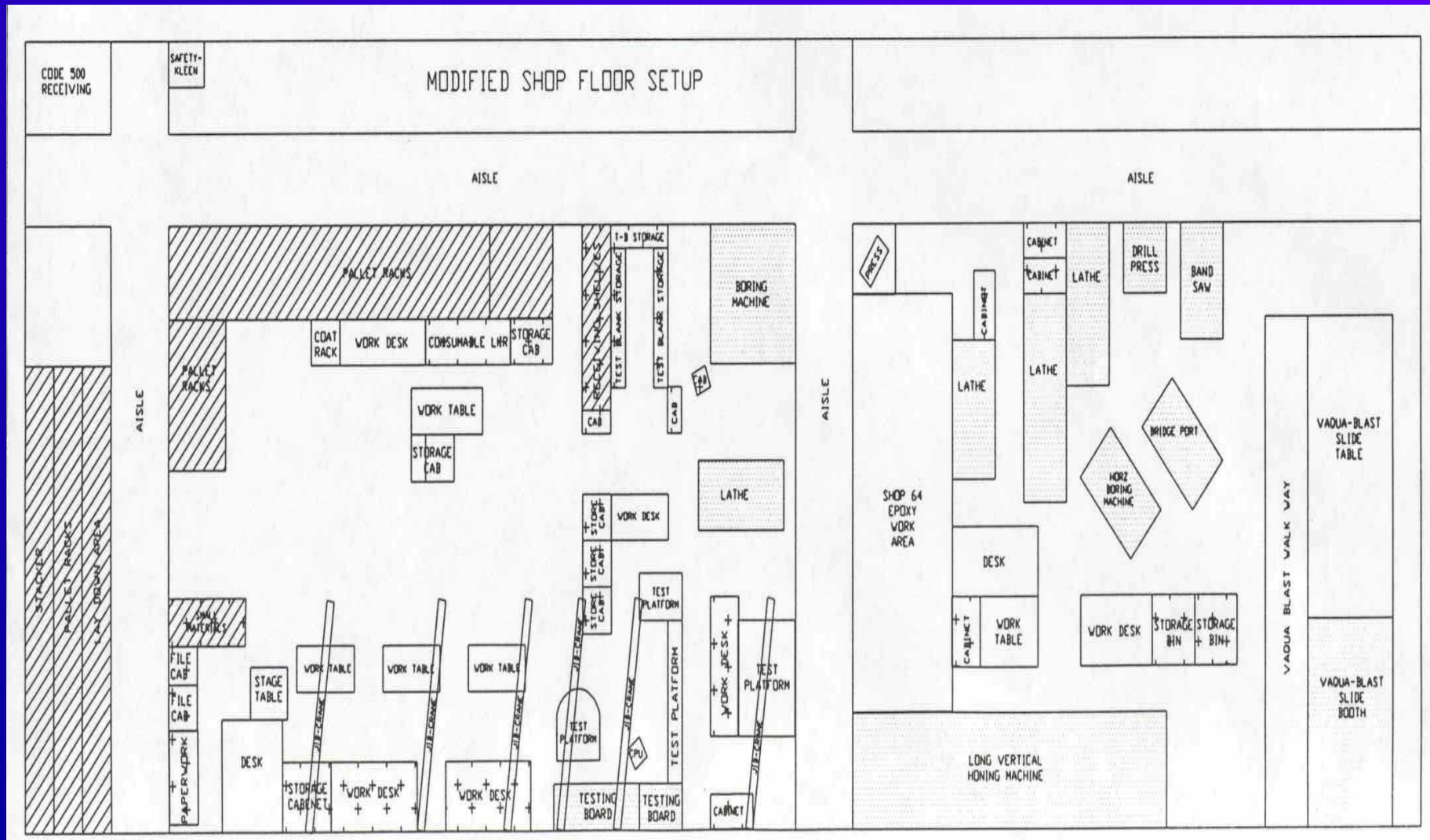
NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Before Layout



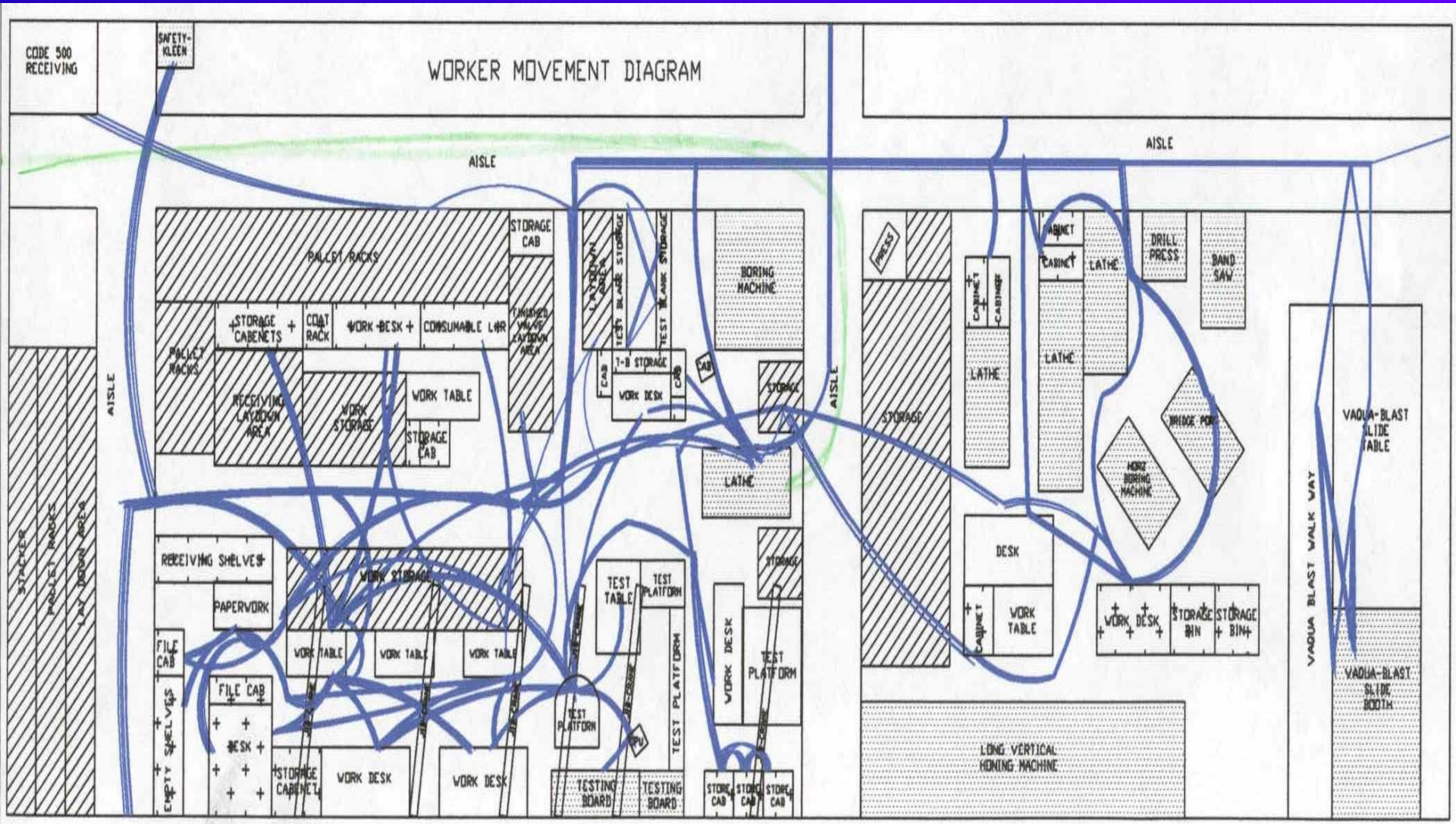
NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Layout After



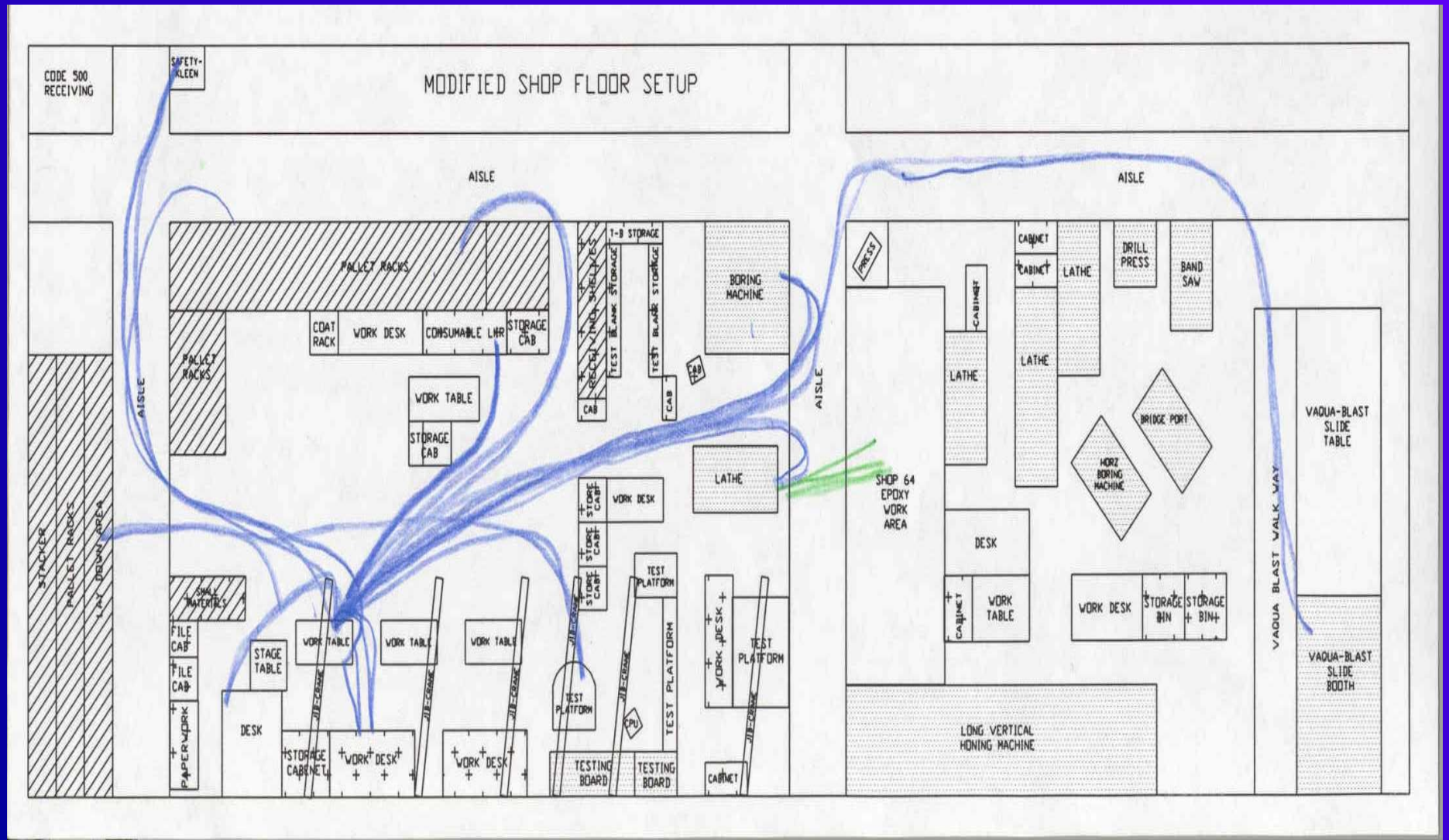
NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Spaghetti Diagram



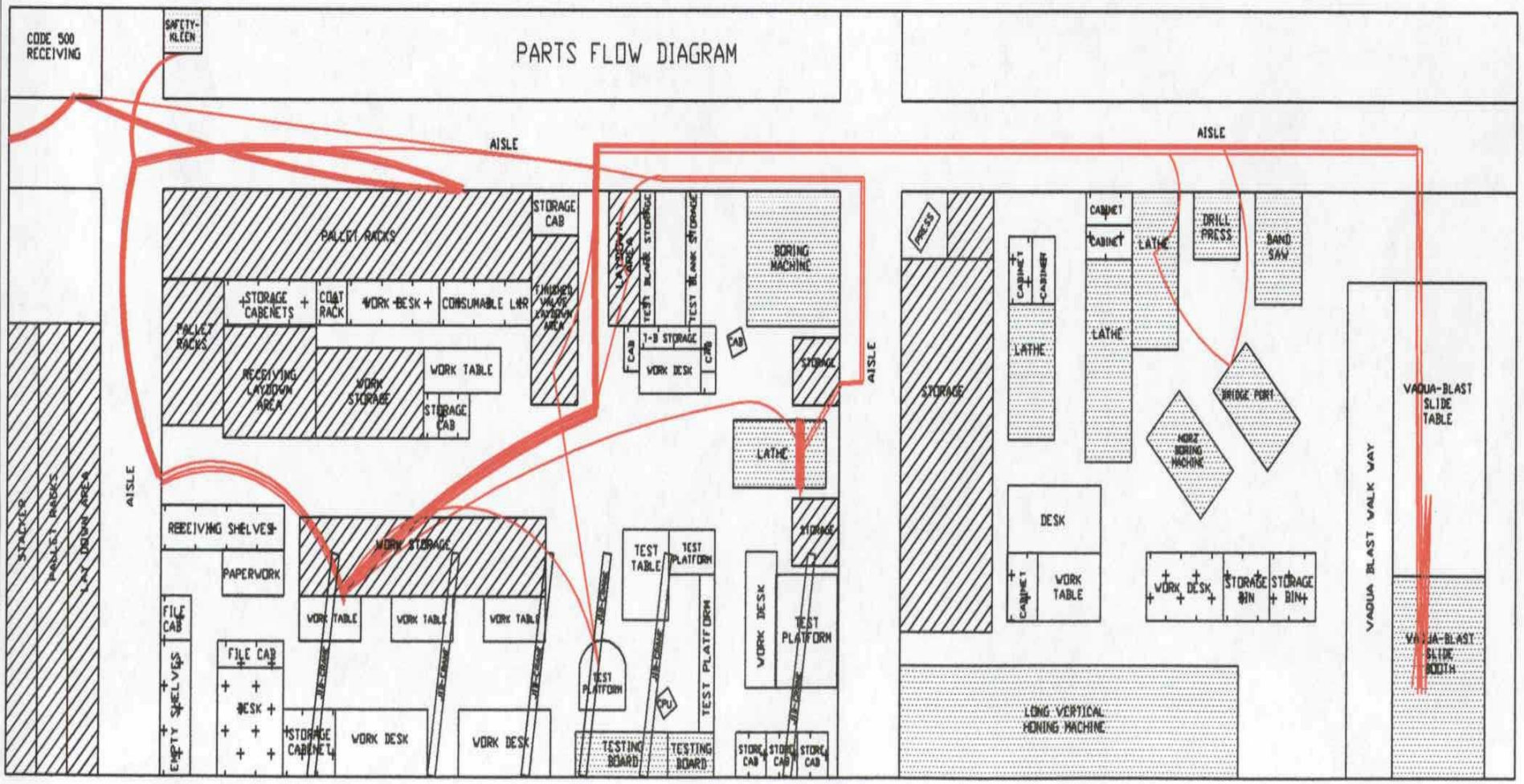
NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# After Mechanic Walking



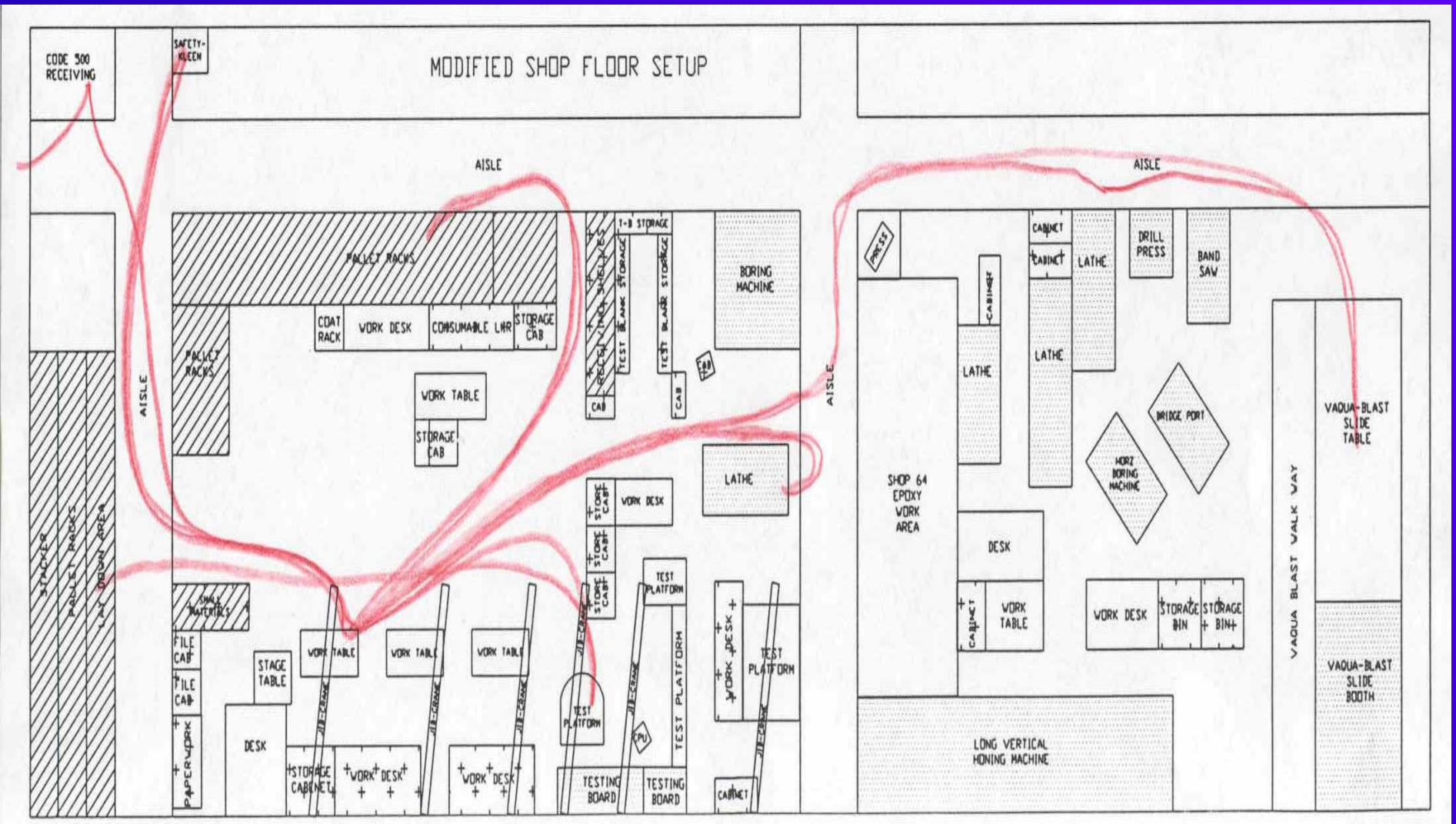
NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Ball Valve Flow Diagram

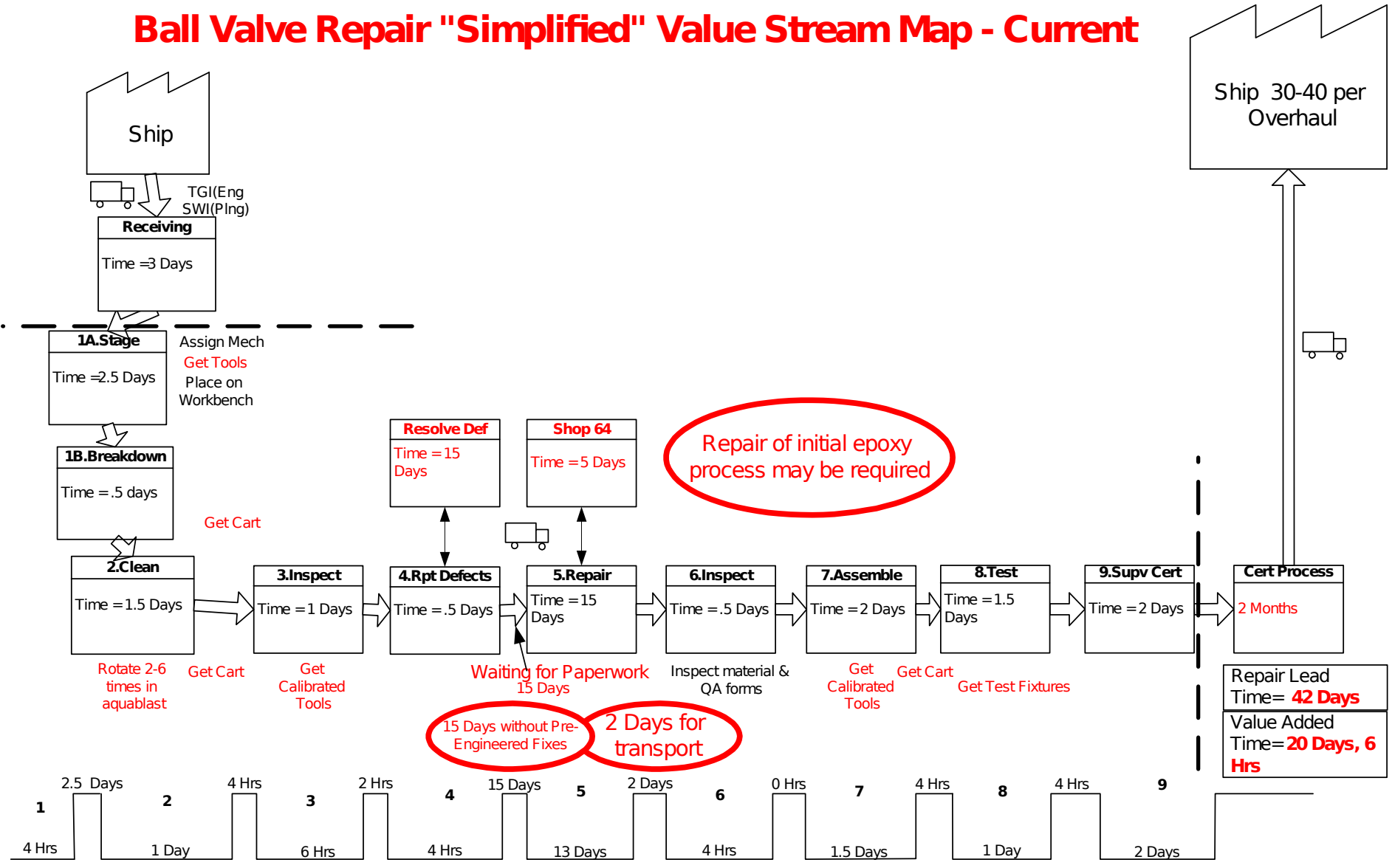


NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

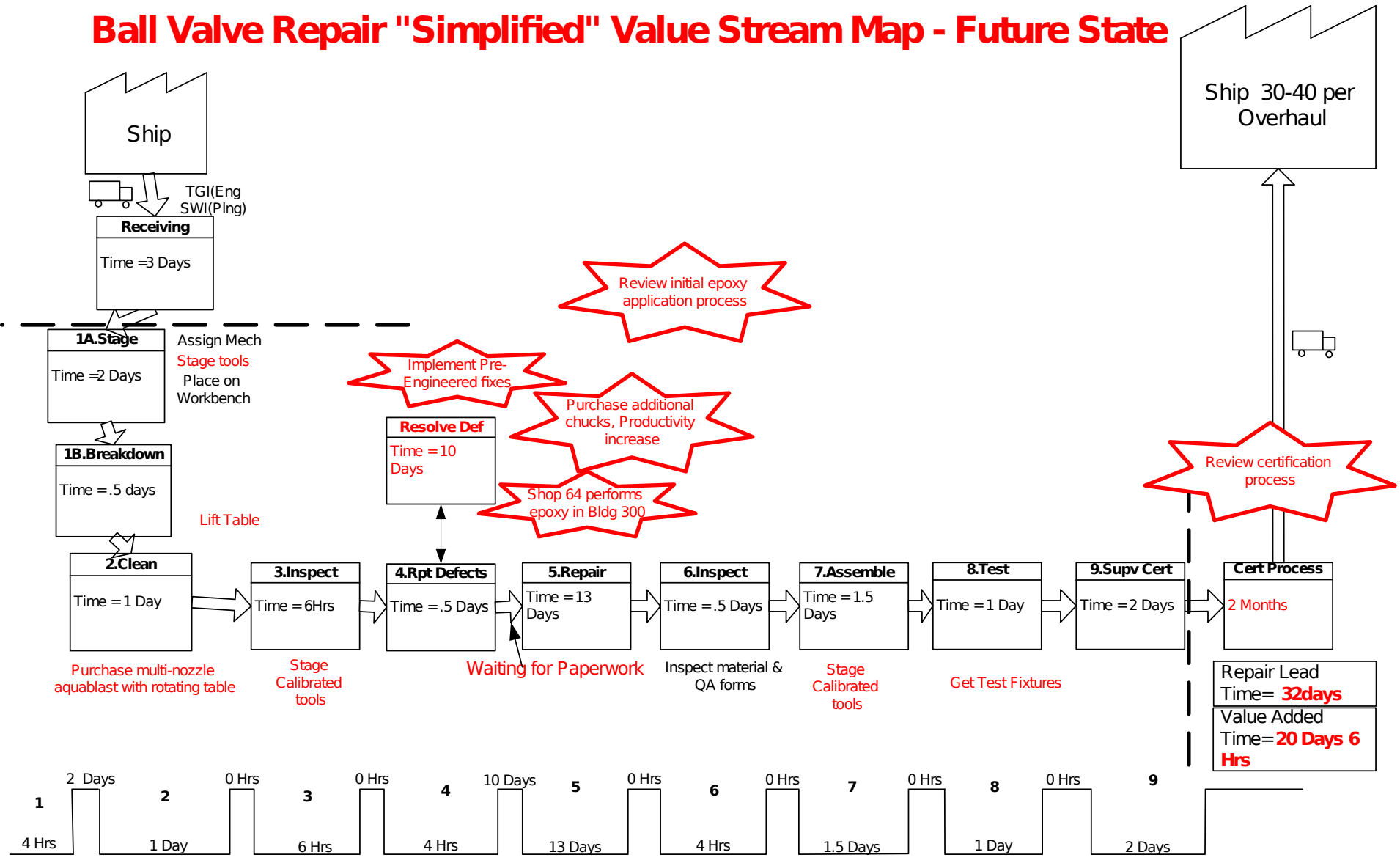
# After Ball Valve Flow



# Ball Valve Repair "Simplified" Value Stream Map - Current



# Ball Valve Repair "Simplified" Value Stream Map - Future State



NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Results

- Safety
  - Reduced Clutter
  - Removed Tripping Hazard (Pallets)
- Improved 5S
  - Identified 132 “tagged” items
  - Completed 104 items

* Reduce Mechanic Walk Distance by 87% (60% Avg.)
* Lead Time Reduced by 25%

- Improved Floor Space Utilization by 51%

* Reduce Part Travel Distance by 88% (50% Avg.)

- Provide Visual Controls
  - There is a place for everything and everything is in it’s place

* At completion of 30 Day Homework page

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# LOW HANGING FRUIT

- Procurement of removable chuck and long jaws
- Initiating pre-engineered and pre-authorized fixes
- Implementing of cold epoxy shim installation method
- Moving X64 into X31 workspace
- Certification Process

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Specific Goals of Workshop

## Circuit Breaker Repair Shop

***Rapid Improvement Workshop***

- Improve Safety
- Improve 5S
  - Identified 80 “tagged” items
  - Goal is to Address 40 items
- Reduce Mechanic Walk Distance by 90%
- Improve Lead Time by 40%
- Improve floor space utilization
- Reduce part travel distance by 50%
- Provide Visual Controls

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Before Situation Measures

- Key Measures
  - Wasted Floor Space – 588 Square Feet
  - Mechanic Walking Distance – 14,044 ft (2.7 Miles)[Add 1 mile for every X64 Mechanic trip to and from Bldg 60]
  - Lead Time – Average is 42 days
  - Part Travel Distance – 1886 ft [Add 1 mile for every trip to and from Bldg 60]
- 132  5-S Items Identified
- Waste Walk
  - Identified 12 items (Motion, Transport, Waiting…)

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Results

| | Current State | Future State | Potential Improvement |
|---|---|---|---|
| Value Added Time (Days) | | 10.5 | |
| 10.5 0% | | | |
| Wait Time (NVA) | | 144.5 | 1 |
| 99% | | | |
| Repair Lead Time = | 155 days | 8.5 days | |
| 90+% | | | |
| Useable Floor Space (SF) | 1,710 | 2,052 | |
| 20% | | | |
| Walking Travel Distance (Feet) | 12,552 | 2,385 | |
| 81% | | | |
| Part Travel Distance (Feet) | 513 | 410 | |
| 20% | | | |

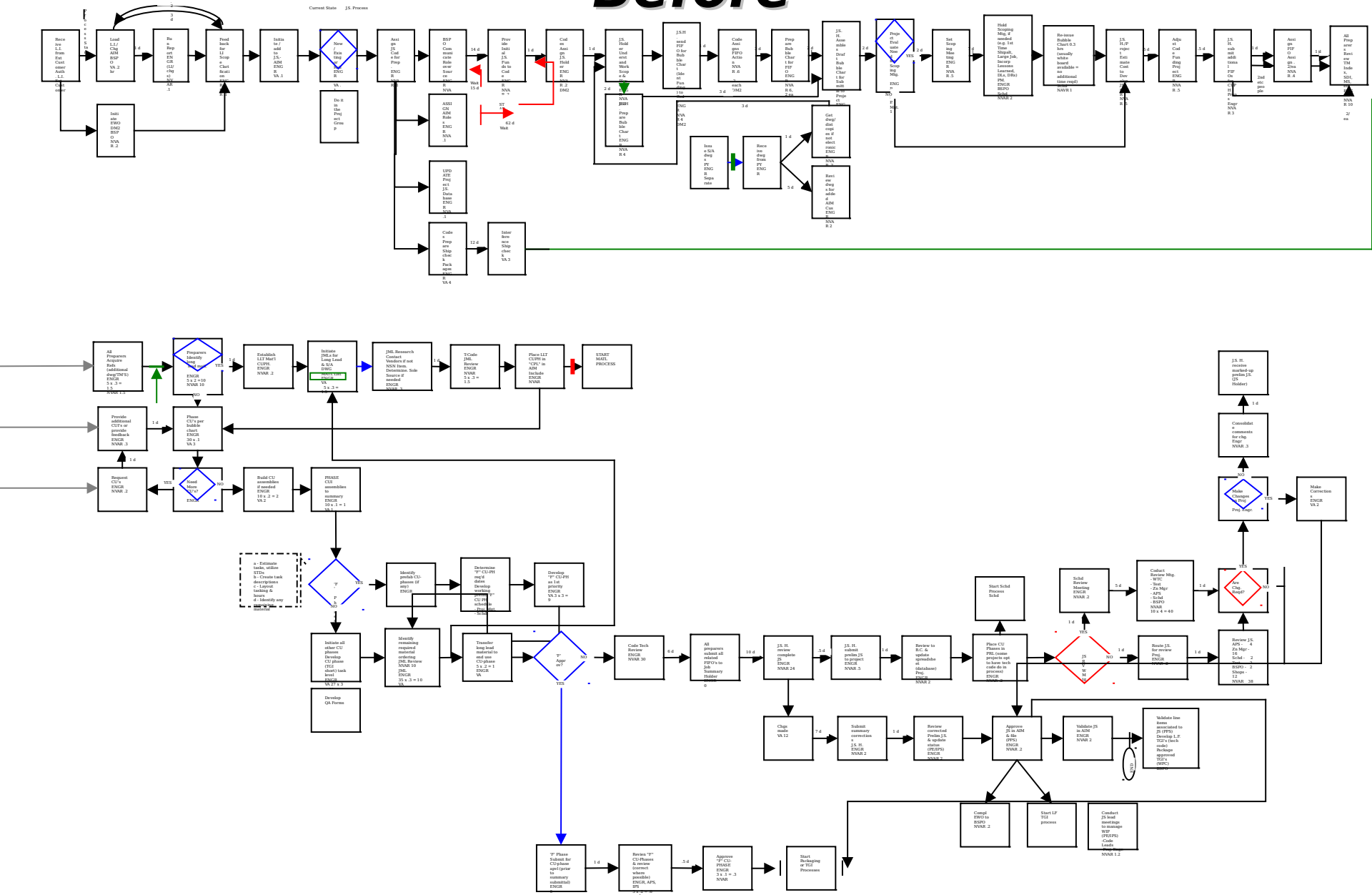
Safety
Improved 5S
Provide Visual Controls

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# *Summary of "Tools" Used in a Focused Workshop Environment*

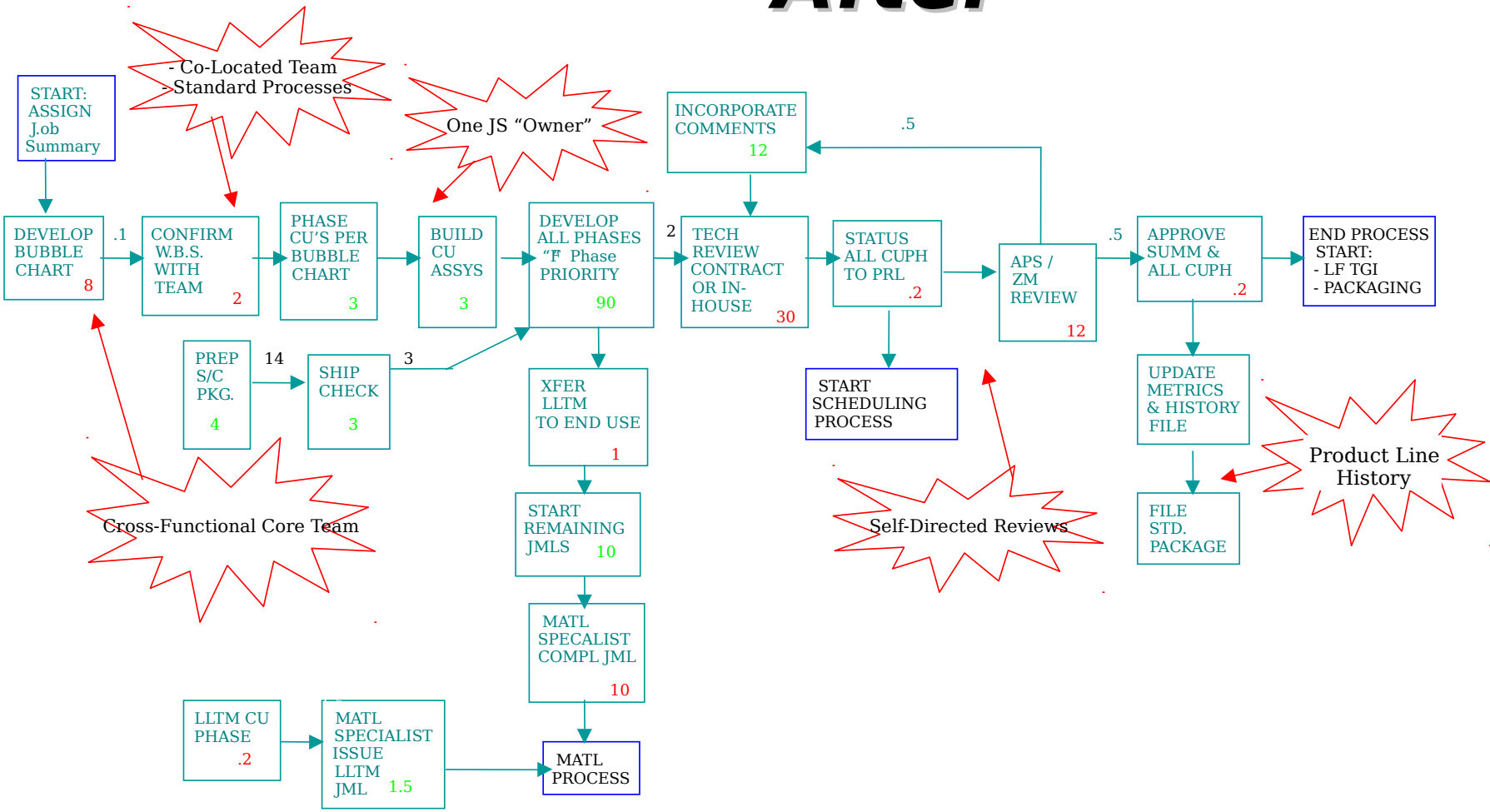
- **Waste Walk**
- **Value Stream Mapping Before & After**
- **Brainstorming**
- **5-S**
  - **Sort/Scrap**
  - **Straighten/Set In Order**
  - **Shine**
  - **Systemize/Standardize**
  - **Sustain**
- **Visual Management**
- **TAKT Time**
- **30 Day Homework List**

# PSNS Job Summary Creation - Before



NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# PSNS Job Summary Creation - After



NAVSEA
NAVAL SEA SYSTEMS COMMAND
Portsmouth Naval Shipyard

# Results of the PSNS Job Summary Lean RIW

| | Current State | Future State | Potential Improvement |
|---|---|---|---|
| Value Added Time (Days) | 15 | 15 | 0% |
| Non-Value Added - Required | 20 | 8 | 60% |
| Wait Time (NVA) | 62 | 3 | 95% |
| Total Lead Time = | 97 | 26 | 73% |
| Travel Distance (Feet) | 30,744 | 2,464 to 13,944 | 55 to 92% |
| Process Steps | 70 | 23 | 67% |
| Hand-Offs | 58 | 10 | 80% |

**Primary Action:**

•Co-located, Cross-functional Team, FIFO's replaced w/focused individual temporarily sits in a work area with the planning team.